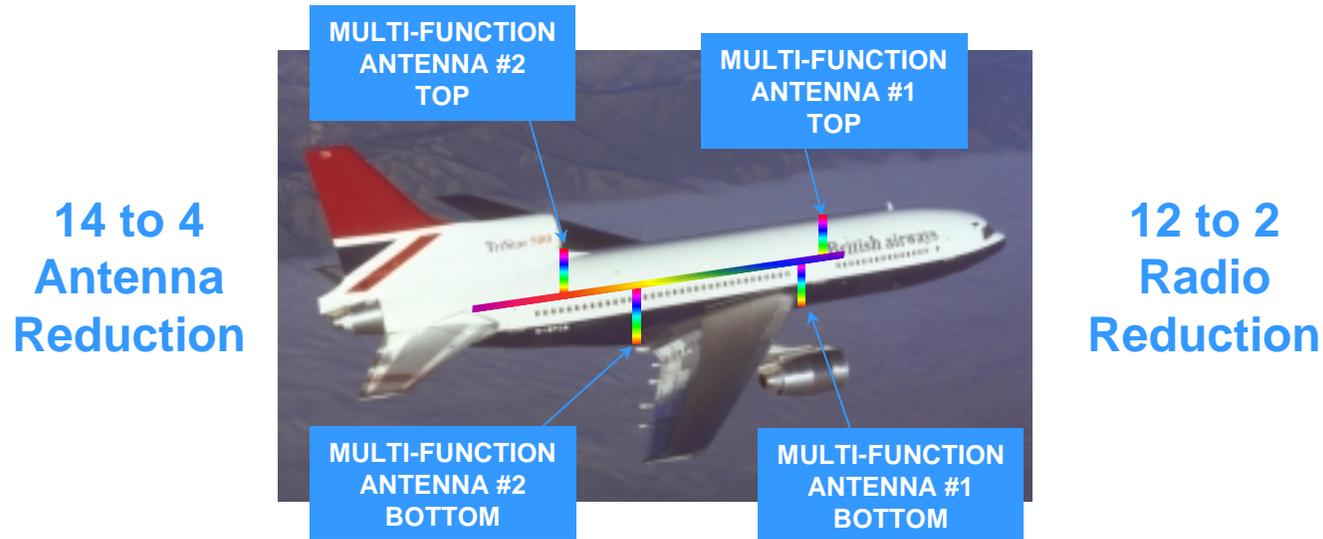


# *Multiplatform FOBWDM™ Embedded Antenna*

*Lockheed Martin - General Electric Shared Vision Program*



## **WDM for Military Applications DARPA Industry Day April 18, 2000**

John Soderberg  
Lockheed Martin Aeronautics - Marietta  
770-494-5748  
john.j.soderberg@lmco.com

Sandy Feldman, PhD  
GE Corporate Research and Development  
518-387-6848  
feldman@crd.ge.com



# Overview

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- Program Goals
- Program Benefits
- Technology Overview
- Development Needs

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# Program Objective

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Use FOBWDM™ to reduce 14 antennas to 4 multiband antennas and 12 radios to 2 WITS™ compliant digital multichannel radios, while enhancing existing performance and reducing antenna system cost, size and weight.



Replace coaxial cable and legacy stovepipe radios with an integrated fiber solution.

\* FOBWDM™ is a trademark of LM Aero-Marietta; Registration application filed

\*\* WITS™ is a trademark of Motorola

(The WITS™ radio is planned to be JTRS compliant)

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# Program Benefits

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- Reduce weight.
- Reduce time and complexity to “wire” the airframe.
- Reduce total lifetime costs.
- Improve overall system performance by replacing legacy stovepipe radios and antennas with an integrated, reprogrammable radio and multiband antenna solution.

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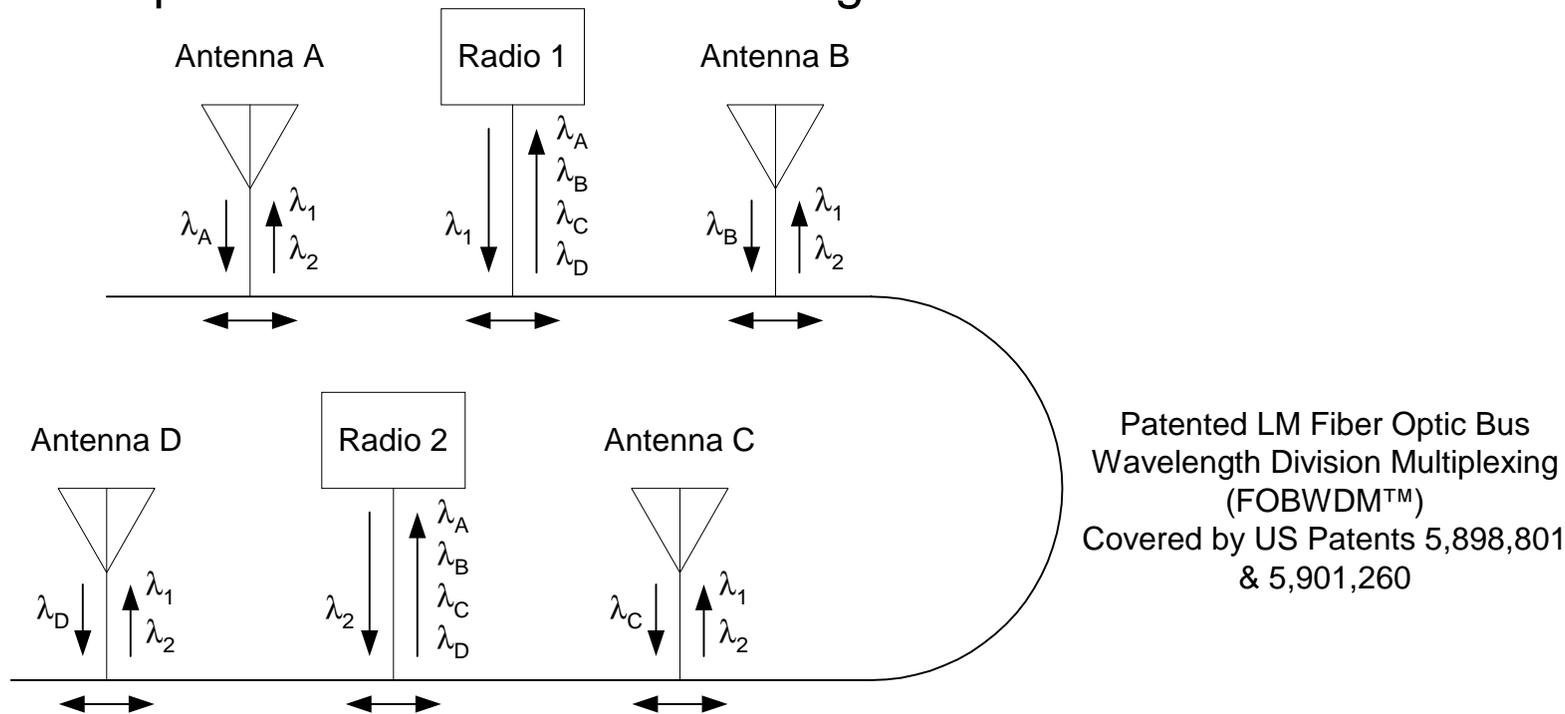
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# Technology Summary

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- Transmit analog RF communication signals on optical fiber.
- WDM provides individual addressing for each antenna and radio.



- This diagram assumes that the entire RF band can be covered using a single modulator. If multiple modulators are used, the number of necessary wavelengths increases. Digital control channels, which place further demands on the mux-demux are not shown.

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# Technology Needs

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## Electro-Optic Modulators

- Cover entire RF bandwidth from 2 MHz to 2 GHz (JTRS specification) with a single optical channel at wavelengths on the ITU grid.
- Specifications for packaged electro-optic modulator:
  - + Dynamic Range: as much as possible; minimum 110 dB-Hz<sup>2/3</sup> (electrical)
  - + Noise Figure: as low as possible; maximum 17 dB (electrical)
- Any linearized modulation scheme, internal or external, is an acceptable solution.
- 0 dB loss in optical subsystem.

Want it all - with no trades

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# Technology Needs

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## WDM Components

- Performance specifications for MUX / DEMUX
  - + Very flat passband (and/or “no-chirp” lasers): can’t afford to impose amplitude modulation due to chirp - frequency drift of laser combined with varying transmission through WDM components. Components must maintain these specifications at aircraft temperatures or be temperature stabilized to withstand the aircraft environment.
  - + Deep band rejection to avoid crosstalk: 40 dB (optical) minimum. Band rejection needs increase as e-o modulation capabilities improve.
- Tunable WDM mux / demux, filters and lasers.
- Rugged, gain-compensated fiber amplifiers, suitable for mixed analog and digital signals.

Off the direct path of digital  
telecommunications development



# Military Application Challenges

- Environmental: components must survive and operate under aircraft temperature and vibration conditions. Mil Standard 810E is a minimum.
- Size issues include module footprint and bend radii on fiber pigtails.
- Manufacturability: “Handwork” keeps prices high and availability low for applications with small- or medium-scale deployments.

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